

## Claims

- [1] A water hammer of a boring machine comprising:  
a tubular main body having a hollow portion;  
a socket coupled to an upper end of the main body and having a water pressure supply passage ;  
a cylindrical piston housing connected to the main body;  
a piston slidably installed in the piston housing, for striking a bit of a bit unit installed at a lower portion of the main body, having a hollow portion through which water is discharged, an annular pressurizing portion protruding on its outer circumferential surface, and a first communication hole connected to the hollow portion ;  
a sliding member fitted into the main body to be coupled to the piston housing, defining a valve installation space, and creating a space portion in which the piston is received when the piston is elevated;  
a valve member defining the valve installation space into first and third space portions along the length of the piston, the first and second space portions having different cross-sectional areas from each other, and valve member forming a second space portion between the first and third space portions , connected to the hollow portion of the piston and connected to the first space portion when the piston is elevated; and  
a water pressure supply unit for supplying high pressure water delivered to the water pressure supply passage of the socket to the first and third space portions.
- [2] The water hammer of claim 1, wherein the valve member comprises:  
a first shield portion installed between the outer circumferential surface of the pressurizing portion and the internal surface of the piston housing ;  
an extending portion extending from the first shield portion and forming a passage through which the first and second space portions are connected to each other when the first shield portion and the pressurizing portion are separated from each other; and  
a second shield portion extending from the extending portion to then be slidably connected to an end portion of the sliding member to form the third space portion.
- [3] The water hammer of claim 2, wherein the valve member includes at least one throughhole extending from the second space portion to an end portion of the sliding member to reduce a cross-sectional area to which a water pressure is applied.
- [4] The water hammer of claim 1, wherein the water pressure supply unit includes a

pump for supplying water having a predetermined pressure to the water pressure supply passage of the socket, a first water pressure passage is formed on at least one of the outer circumferential surface of the sliding member and the main body, a second communication hole connected to the third space portion is formed in the sliding member, a second water pressure passage formed on at least one of the outer surface of the sliding member and the inner circumferential surface of the main body so as to be connected to the first water pressure passage, and a third communication hole is formed to connect the second water pressure passage with the first space portion.

- [5] The water hammer of claim 1, wherein the socket further includes a check valve unit for preventing backflow of water through the water pressure supply passage.
- [6] A water hammer comprising:
  - a tubular main body having a hollow portion;
  - a socket coupled to an upper end of the main body and having a water pressure supply passage ;
  - a cylindrical piston housing connected to the main body;
  - a piston slidably installed in the piston housing, having a hollow portion through which water is discharged, an annular pressurizing portion protruding on its outer circumferential surface, and a first communication hole connected to the hollow portion ;
  - a sliding member fitted into the main body to be coupled to the piston housing, defining a valve installation space, and creating a space portion in which the piston is received when the piston is elevated;
  - a valve member slidably installed in the valve installation space and defining the same into a first space portion and a second space portion, the cross-sectional area of the first space portion along the length of the piston being larger than that of the second space portion along the length of the first space portion, and the valve member defining a second space portion between the first and third space portions , connected to the hollow portion of the piston; and
  - a water pressure supply unit for supplying pressure water to the first and second space portions to firstly elevate the valve member using a difference between the cross-sectional area of the first space portion and the cross-sectional area of the second space portion to secondly elevate the piston, causing the water used to elevate the housing to be discharged to the hollow portion of the piston in such a manner that the first and second space portions are connected to each other when the piston elevates, and supplying water pressure to the third space portion to cause the valve member to be lowered.
- [7] The water hammer of claim 6, wherein the valve member includes a first shield

portion installed between the outer circumferential surface of the pressurizing portion and the internal surface of the cylinder member, an extending portion extending from the first shield portion and forming a passage through which the first and second space portions are connected to each other when the first shield portion and the pressurizing portion are separated from each other, and a second shield portion extending from the extending portion to be slidably coupled to an end portion of the sliding member to form the third space portion.

- [8] The water hammer of claim 6, wherein the valve member includes at least one throughhole extending from the second space portion to an end portion of the sliding member to reduce a cross-sectional area to which a water pressure is applied.
- [9] The water hammer of claim 6, wherein the water pressure supply unit includes a pump for supplying water having a predetermined pressure to the water pressure supply passage of the socket, a first water pressure passage is formed on at least one of the outer circumferential surface of the sliding member and the main body, a second communication hole connected to the third space portion is formed in the sliding member, a second water pressure passage is formed on at least one of the outer surface of the sliding member and the inner circumferential surface of the main body so as to be connected to the second water pressure passage, and a third communication hole is formed to connect the second water pressure passage with the first space portion.
- [10] The water hammer of claim 6, wherein the pressurizing portion of the piston has different diameters at its opposite ends.
- [11] The water hammer of claim 9, further comprising a drive rod connected to the socket to supply high pressure water.
- [12] The water hammer of claim 11, wherein the drive rod comprises: a tubular main body having a hollow portion;  
a first connection member installed at an upper portion of the main body and having an inlet;  
a second connection member installed at a lower portion of the main body and having an outlet; and  
an internal pipe having an upper end fixed to be connected with the inlet of the first connection member, extending toward the second connection member to partition the hollow portion of the main body lengthwise to form an air storage portion, and having at least one discharge hole for discharging water in a radial direction to isolate water from air, the discharge hole formed at an end portion of the internal pipe.
- [13] The water hammer of claim 12, wherein the end portion of the internal pipe is

connected to the outlet of the second connection member, a shield plate is installed at a side of the internal pipe proximal to the second connection member to cause water induced through the internal pipe to be discharged through the discharge hole, and at least one entrance hole for causing water discharged through the discharge hole to be induced to the outlet is installed at the internal pipe disposed at the lower portion of the shield plate.

- [14] The water hammer of claim 12, wherein the end portion of the internal pipe has a shield member for causing water to be discharged through the discharge hole, and is supported by at least one rib installed on the internal surface of the main body.
- [15] The water hammer of claim 12, wherein the drive rod includes a tubular main body having a hollow portion, and an accumulator unit for isolating the water induced from the hollow portion of the main body from air.